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Beamtime results and Sensor characterization

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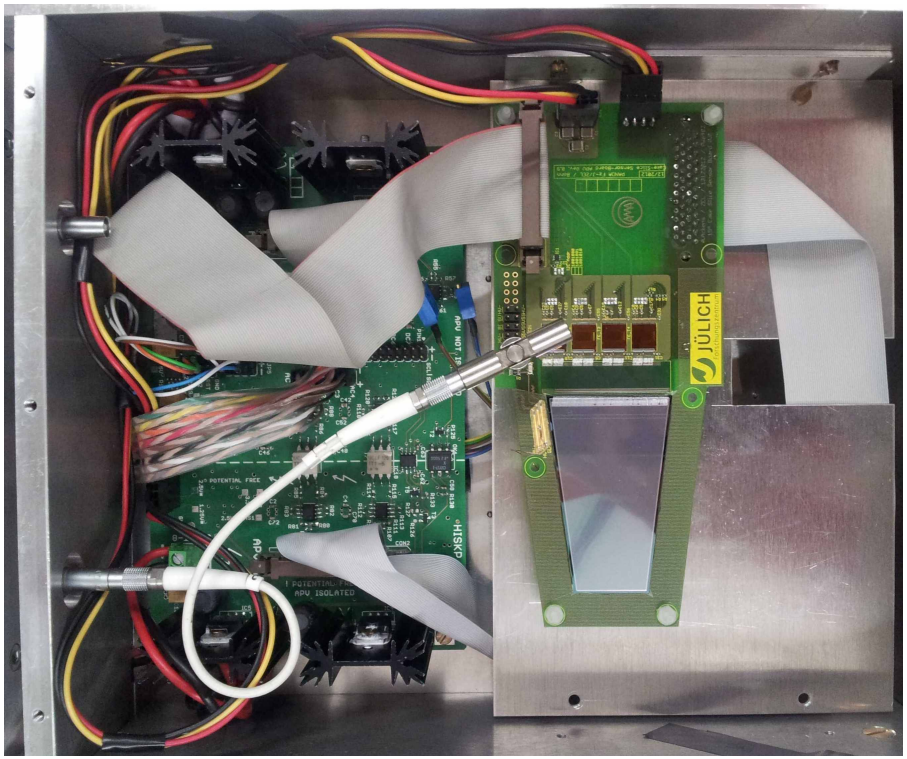
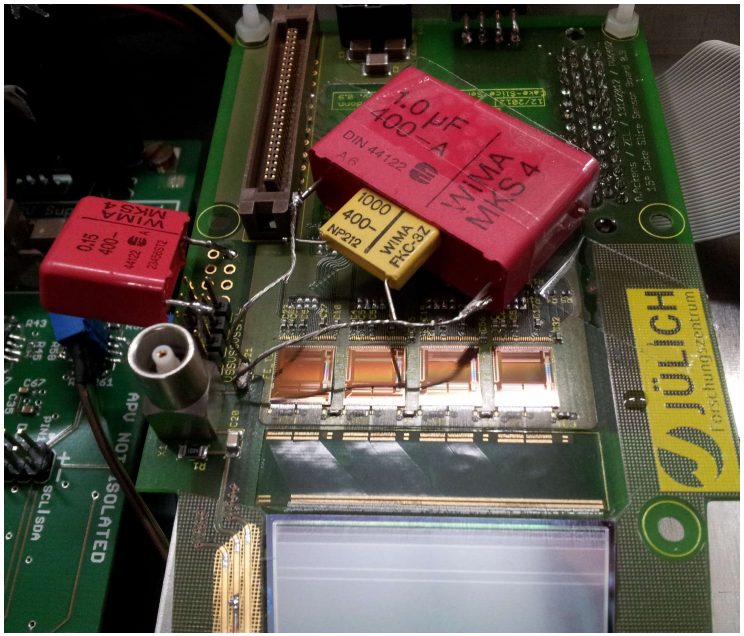
beamtime

On the first run all APV25s responded, but noise covered any signal.

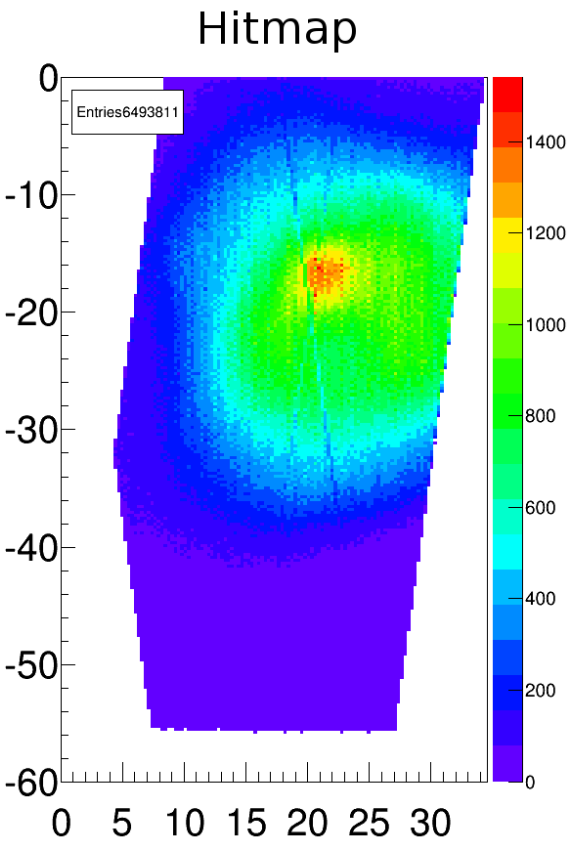


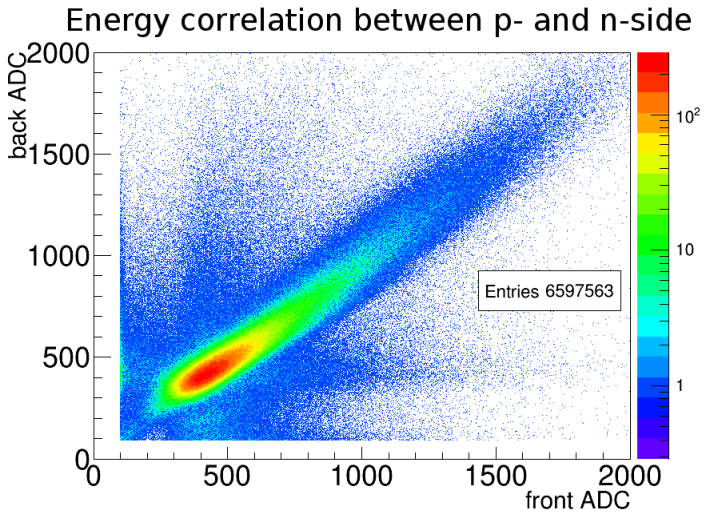
beamtime

After adding some capaciters to stabilize p- and n-side frontend LV against each other, noise went down significantly!



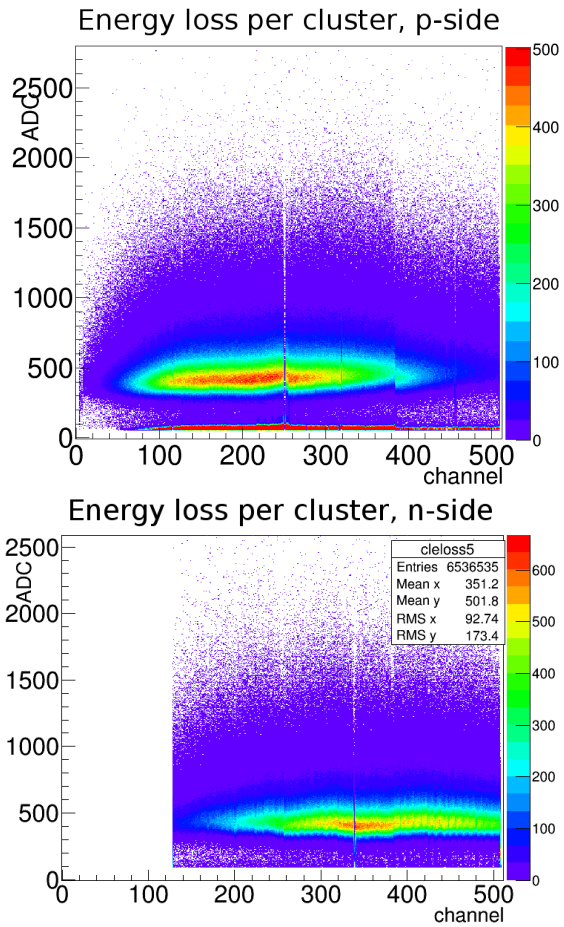
beamtime





- Beam spot clearly visible
- Good correlation between n- and p-side
- One APV25 on the n-side died

beamtime



- Noise and signal are separateable by chosing the right threshhold
- Revised sensor board is in production to improve noise situation

η distribution

The η distribution is a helpful tool to reconstruct the original hit point from two strip entries.

Definition of η

$\eta = \frac{q_r}{q_r + q_l}$, where q_r and q_l are the deposited charges in the right strip and left strip.

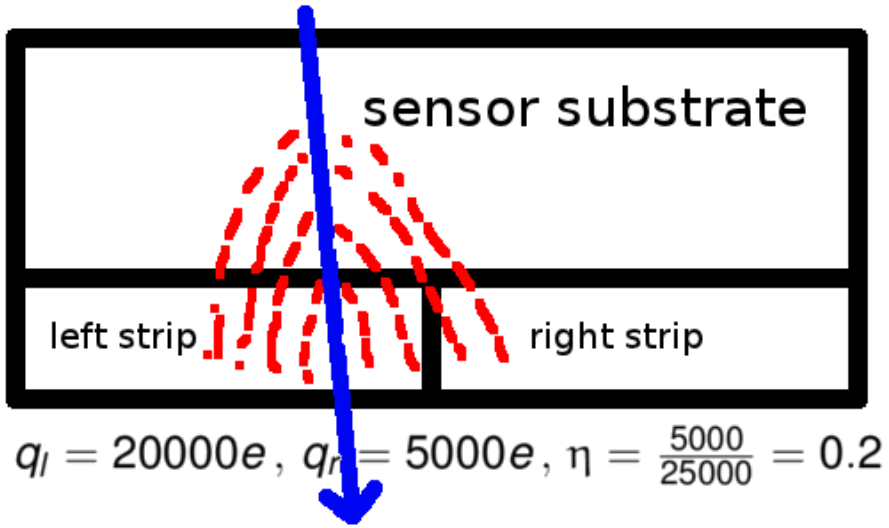


Figure : Two strips getting hit by a particle and resulting η value

To use the η value for hit reconstruction it is necessary to determine the distribution of η values for evenly spread hits on the sensor.

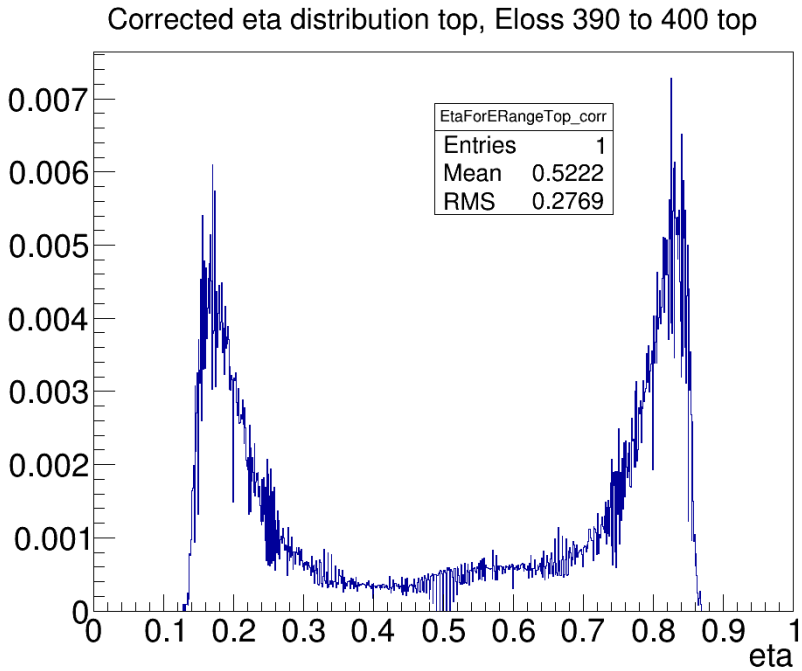


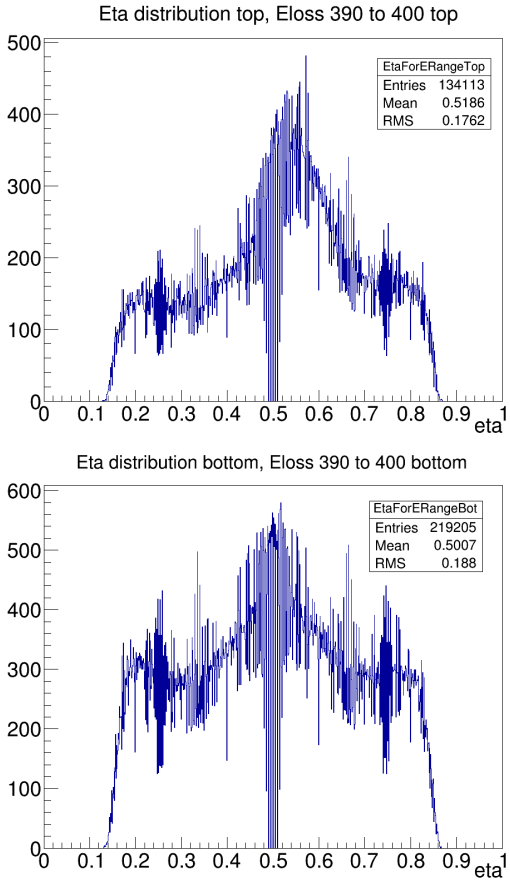
Figure : typical η distribution

Hit position x:

$$x = x_l + \frac{1}{N_0} \int_0^{\eta} \frac{dN}{d\eta}$$

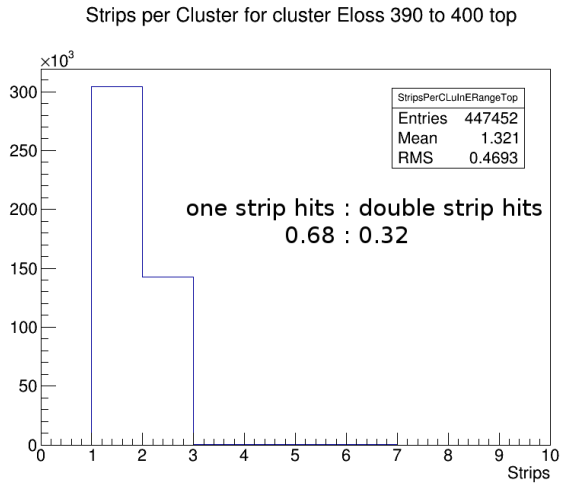
In that equation x_l is the left strip number and N_0 is the number of entries in the η distribution.

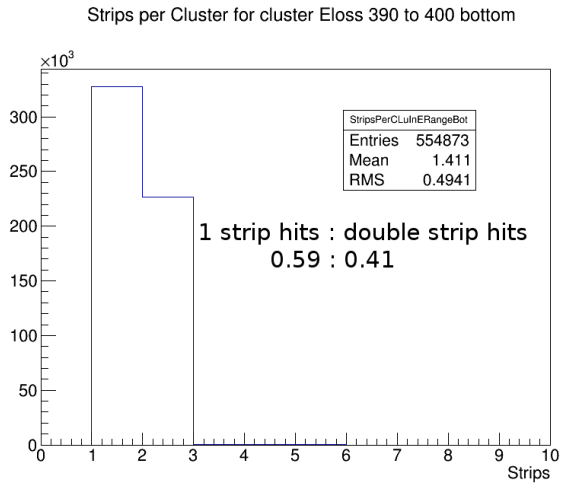
η Distribution from Beamtime

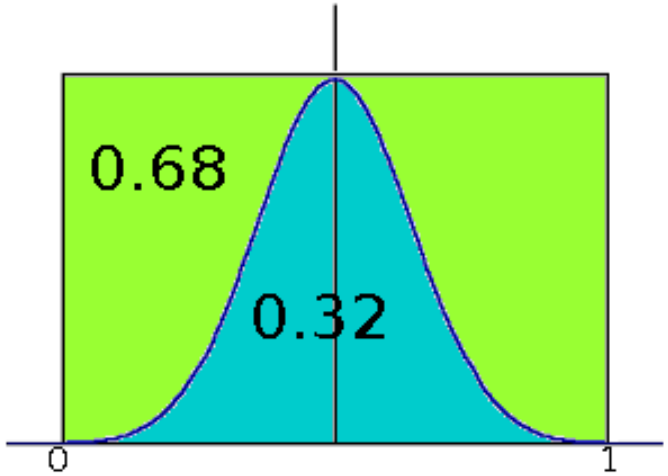


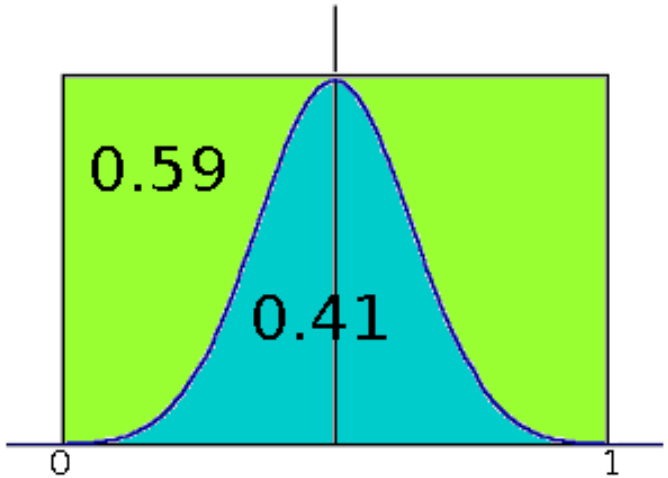
- Does not look like a typical *upeta* distribution
- Most hits close to a strip do not fire its neighbour
- The p-side *upeta* distribution has a little overweight to the right strip for some reason

Single Hit to Double Hit Ratio





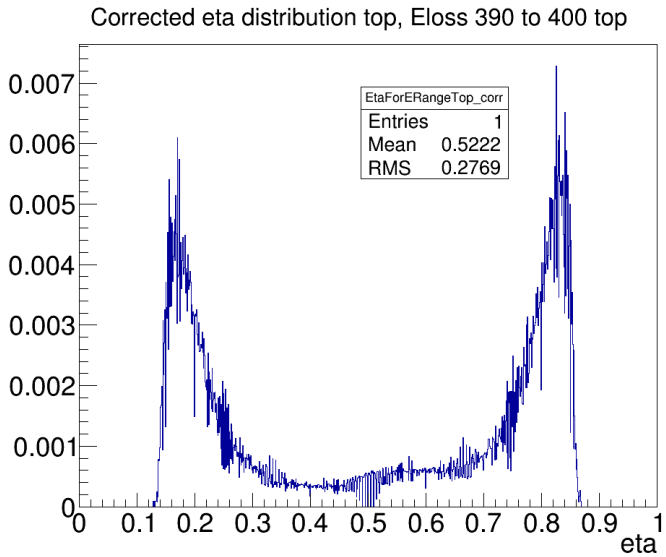


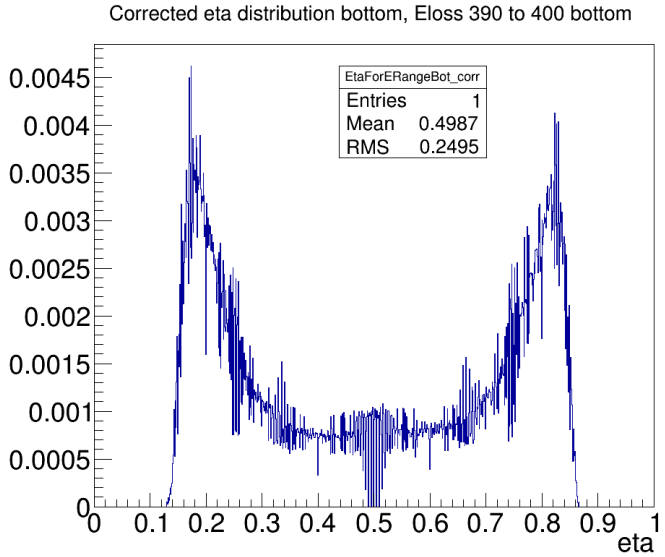


$$e^{-k\cdot(x-0.5)^2}$$

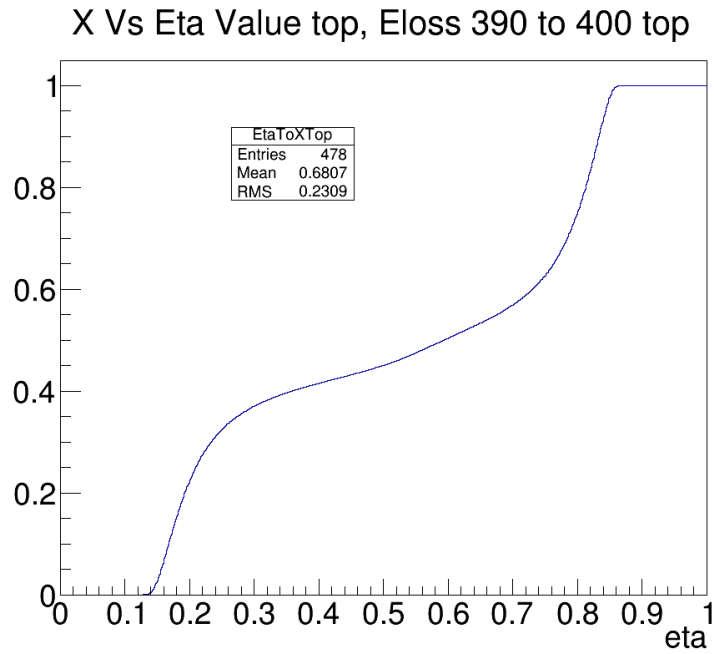
Corrected η Distribution

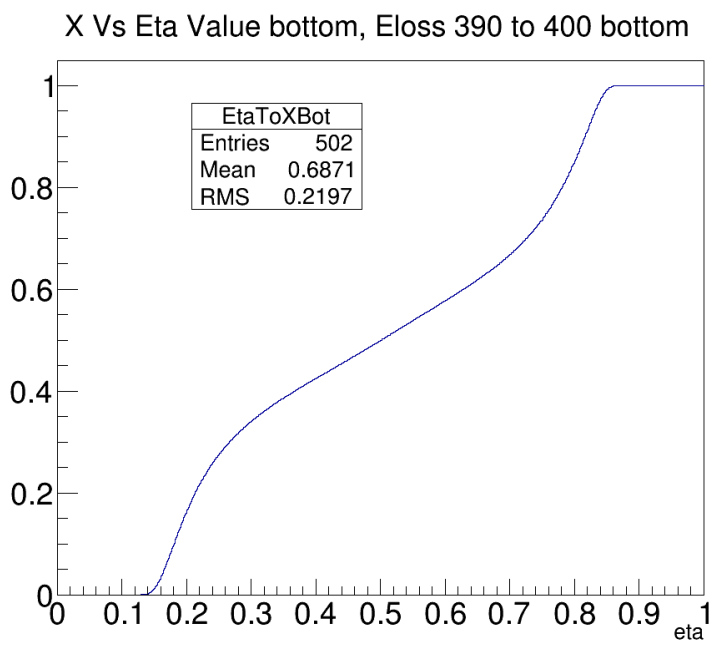
$N_{corr.}(\eta) = \frac{N(\eta)}{N_0 \cdot e^{-k \cdot x^2}}$, with $k = 30.34$ for p-side and $k = 18.63$ for n-side.





Transform to $x(\eta)$



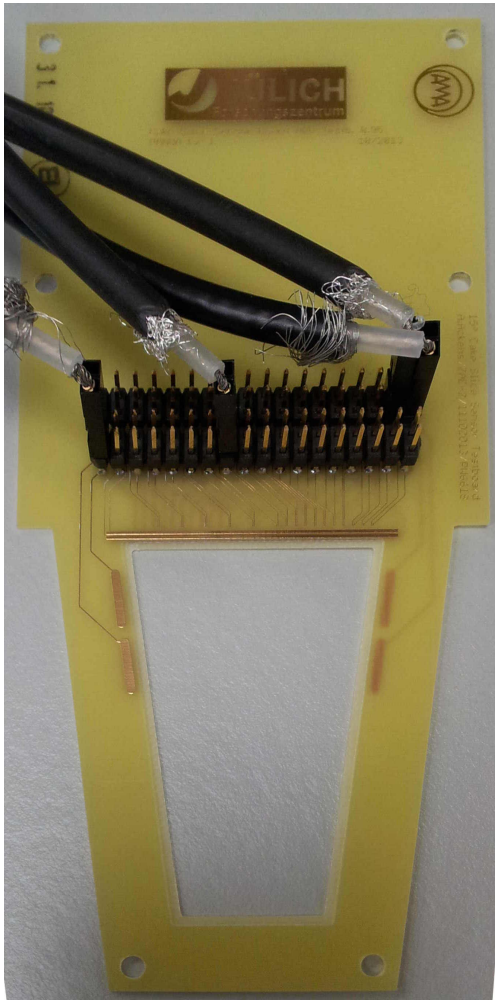


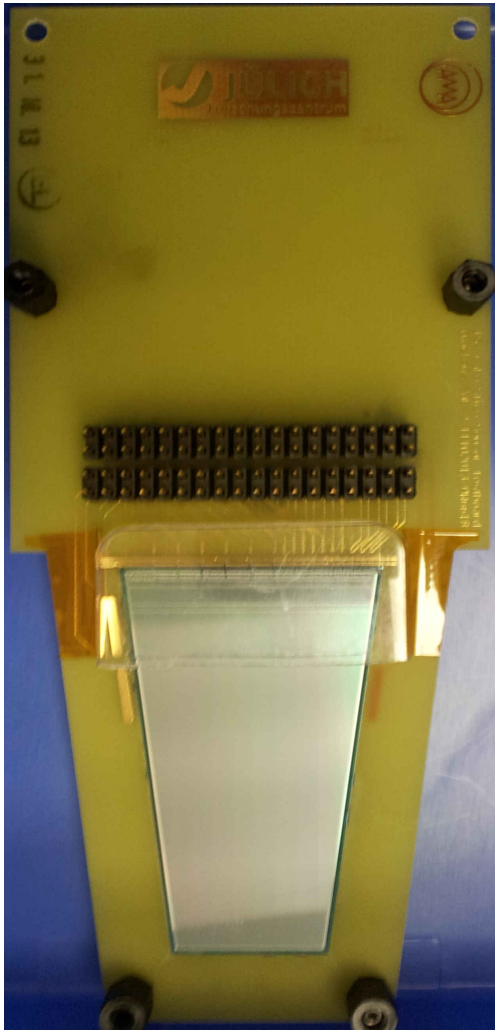
Sensor Characterization

- Characterization has been done with a test board and a probestation
- Test board achieved high precision
- Probe station measurement is non-destructive

Test Board

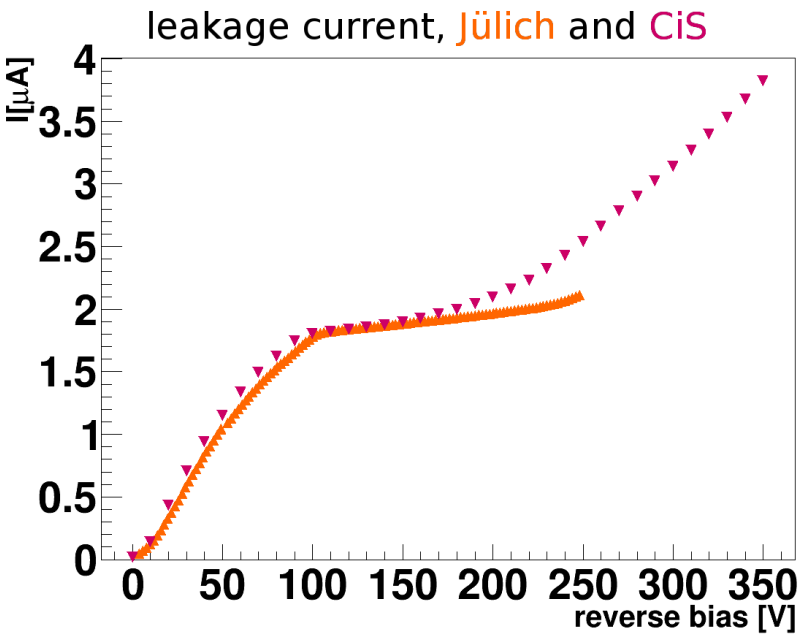
I used an empty test board for calibration purposes.



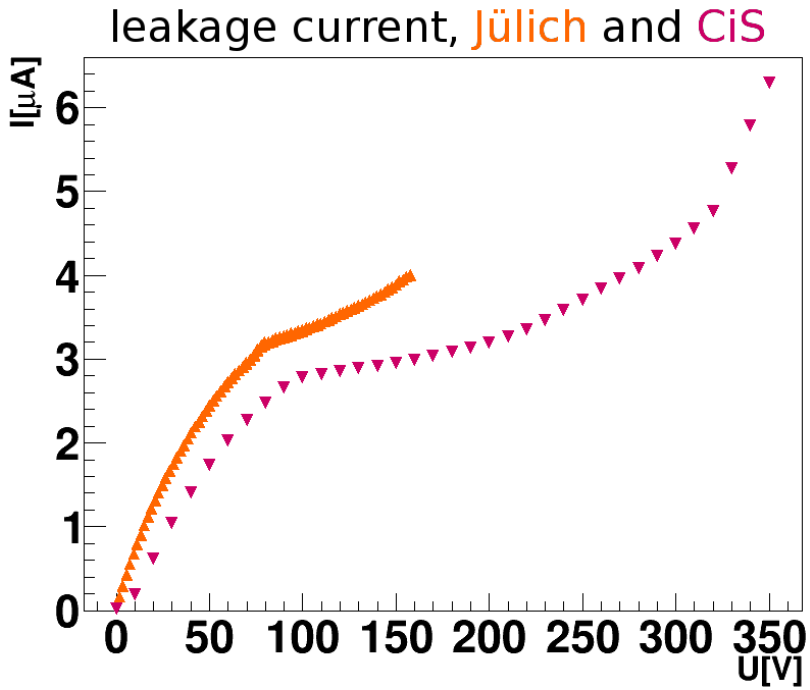


Leakage Current

test board:

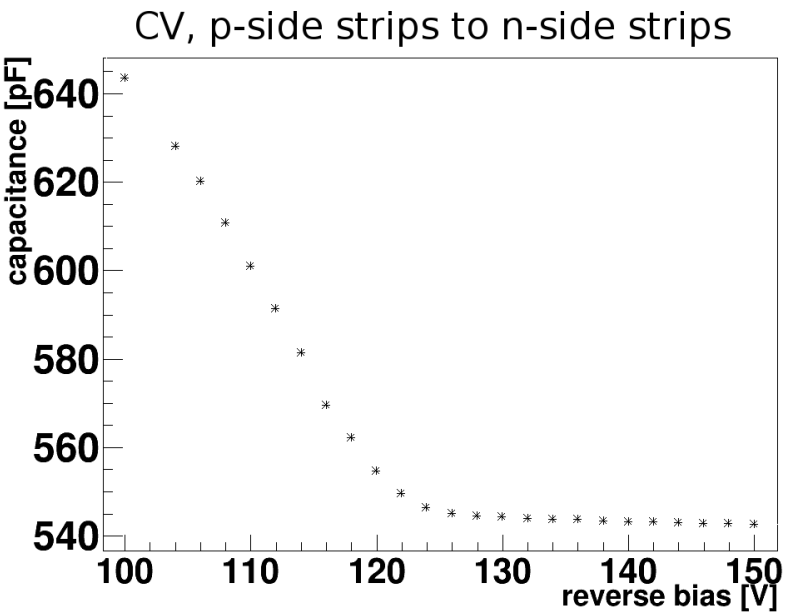


probe station:

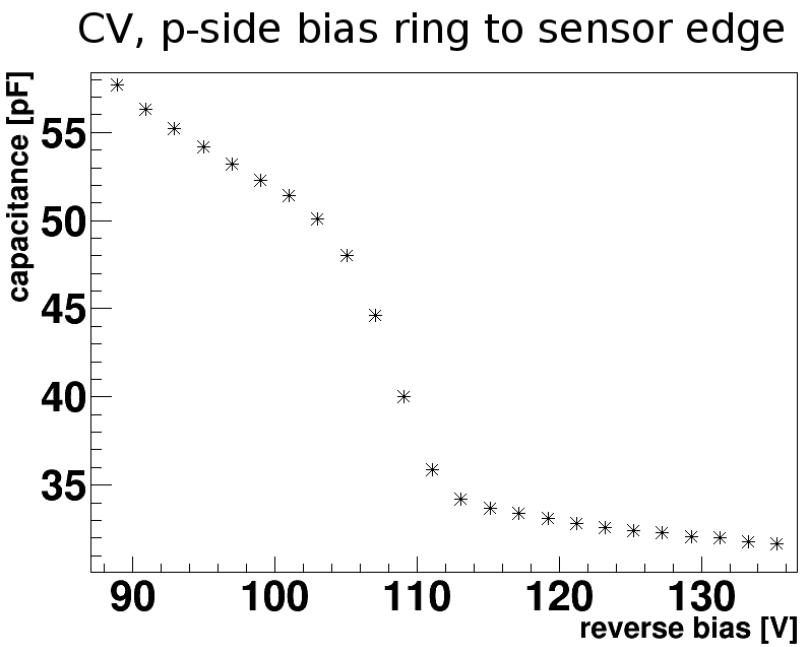


Sensor Capacitance

test board:

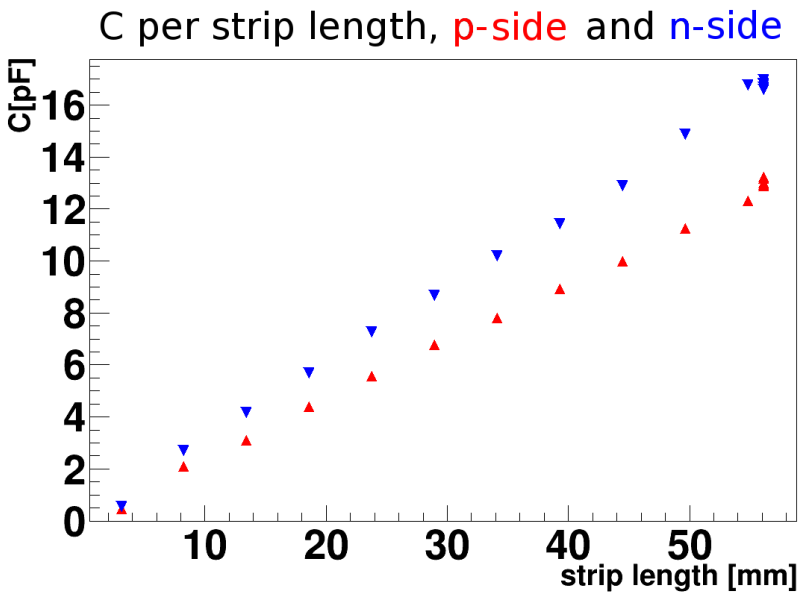


probe station:

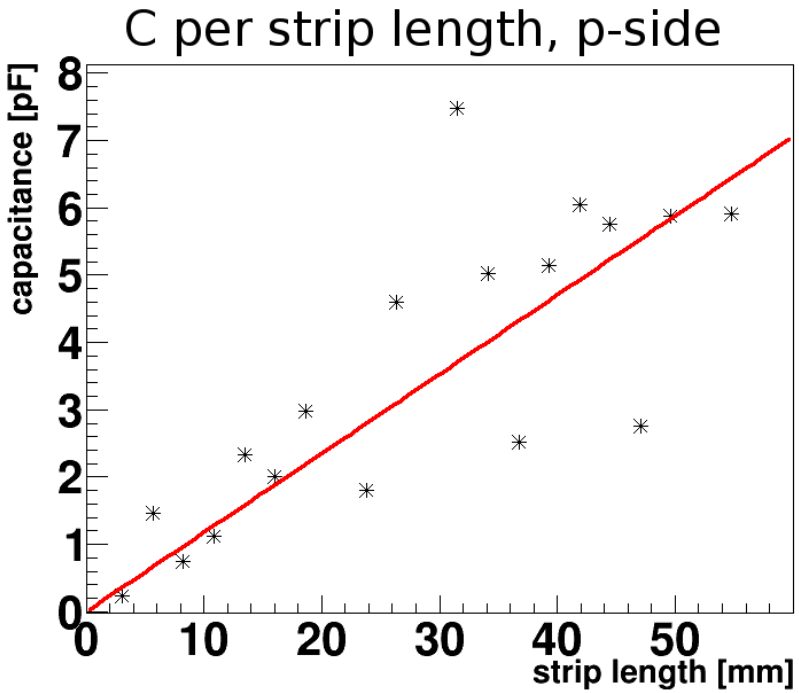


Strip Capacitance vs Strip Length

test board:

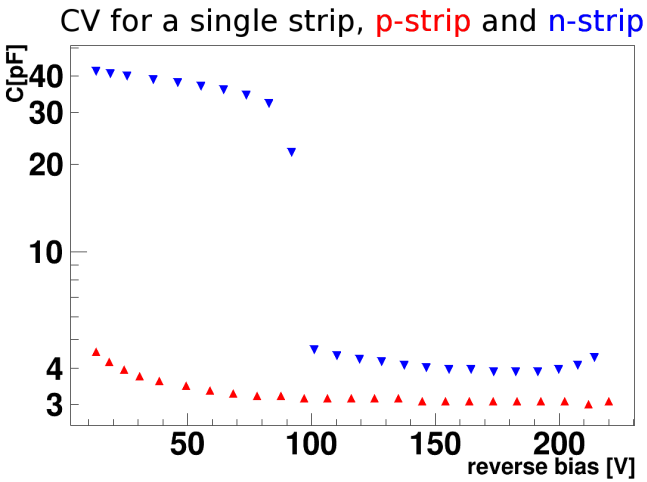


probe station:



Strip Capacitance Vs Strip Length

test board:



- n^+-doped strips inside a n^--doped material
- They connect to each other and we see a much bigger capacitance compared to p-side
- When depletion zone reaches the strips, connection to their neighbours is destroyed and capacitance drops immediately

Summary

- First beamtime for trapezoidal sensor was successful
- Second revised version of sensor board is in production
- Sensor characterization with test board offered insight into sensor functionality
- Probe station allows to characterize sensors before assembly

Thank you for your attention!